

New record and geographic range extension of *Ephemera* (*Ephemera*) *spilosa* Navás, 1936 (Ephemeroptera, Ephemeridae) from Thailand

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Abstract. *Ephemera* (*Ephemera*) *spilosa* Navás, 1936 was first described from China at the imaginal stage. Subsequently, in 2008, the nymph of *E. spilosa* was described from Vietnam. These are the only two known occurrences of this species. This study contributes the first record of *E. spilosa* from Thailand and provides a distribution map for this species.

Key words. Distribution map, ephemerid, mayflies, new distribution record

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INTRODUCTION

The genus *Ephemera* Linnaeus, 1758 is a common group of mayflies in the family Ephemeridae and encompasses 68 species globally, with approximately 34 species named from southern China and Southeast Asia (Hwang et al. 2007). In tropical Southeast Asia, 16 species of the genus *Ephemera* have been reported: *E. annandalei* Chopra, 1927, *E. duporti* Lestage, 1921, *E. exspectans* (Walker, 1860), *E. formosana* Ulmer, 1919, *E. hainanensis* Zhang et al., 1995, *E. innotata* Navás, 1922, *E. javana* Navás, 1930, *E. longiventris* Navás, 1917, *E. mccaffertyi* Hwang & Bae, 2008, *E. pulcherrima* Eaton, 1892, *E. purpurata* Ulmer, 1919, *E. quadriguttata* Lestage, 1927, *E. rufomaculata* Zhou & Zheng, 2003, *E. sauteri* Ulmer, 1912, *E. serica* Eaton, 1871, and *E. spilosa* Navás, 1936. In Thailand, only two species of the genus *Ephemera* have been identified: *E. rufomaculata* and *E. purpurata* (Kluge 2004; Hwang and Bae 2008). Recently, we conducted an extensive survey of mayflies in northern Thailand. This study documents the first record of *E. (E.) spilosa*, based on nymphs from Chiang Mai province, Thailand. Kluge (2022) placed this species under the subgenus *Ephemera* (s.s.). We also provide a map of all known occurrences of this species.

METHODS

Larvae of ephemerid specimens were collected from streams and rivers and preserved in absolute ethanol. Size measurements (mm) and photographs were captured using Nikon SMZ800 and ZEISS Stemi 305 stereoscopic microscopes. The final plates were prepared with Adobe Photoshop CC 2022. The materials are deposited in the collection of the Zoological Museum at Kasetsart University in Bangkok, Thailand (ZMKU). The distribution map was constructed using Simple Mapper (Shorthouse 2010) and geographic coordinates of known occurrences of the species.

RESULTS

Ephemera (*Ephemera*) *spilosa* Navás, 1936

Figures 1–3

New records. THAILAND – CHIANG MAI • Jom Thong district, Siribhumi waterfall; 18°32'50.9"N,



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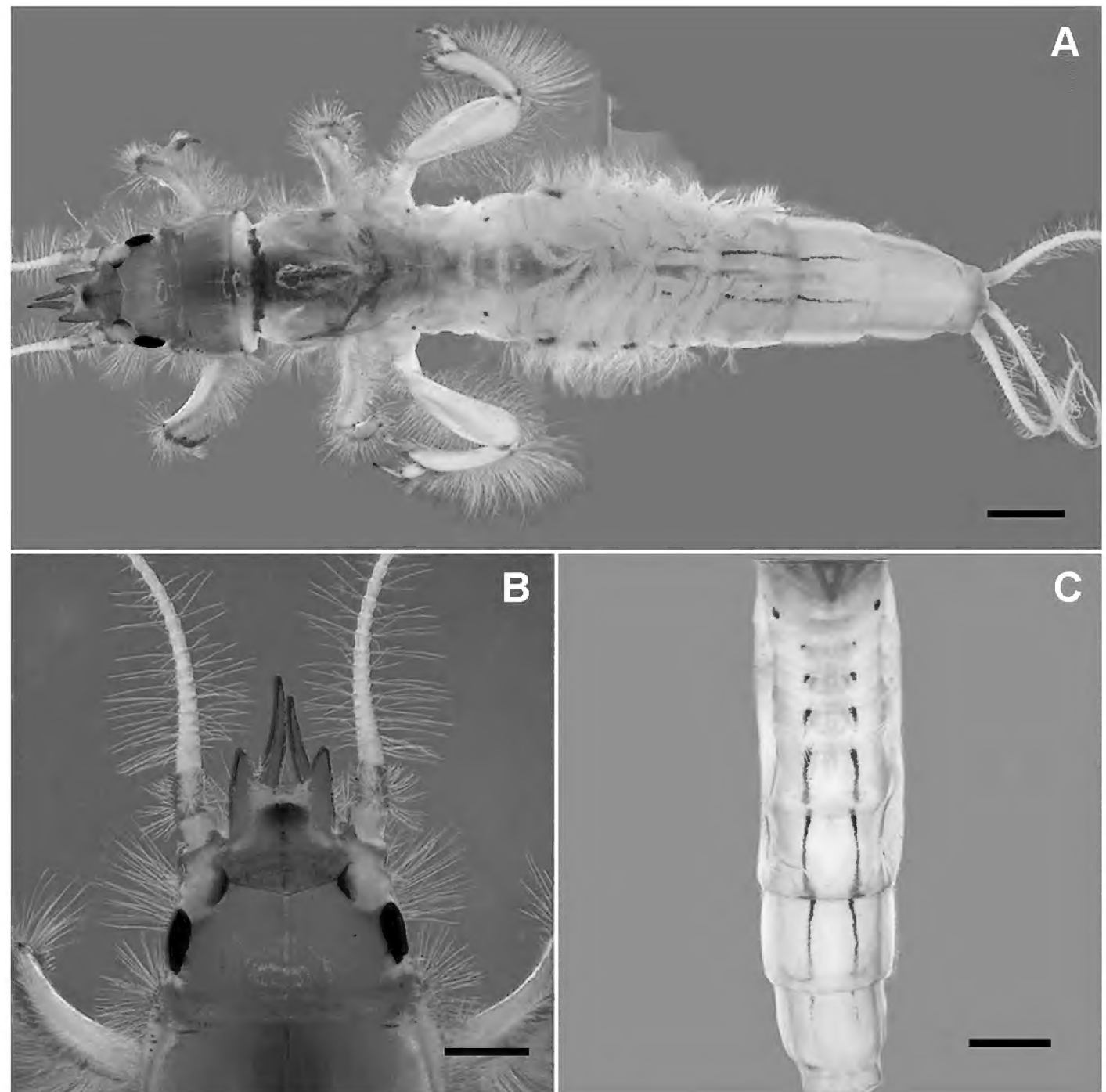
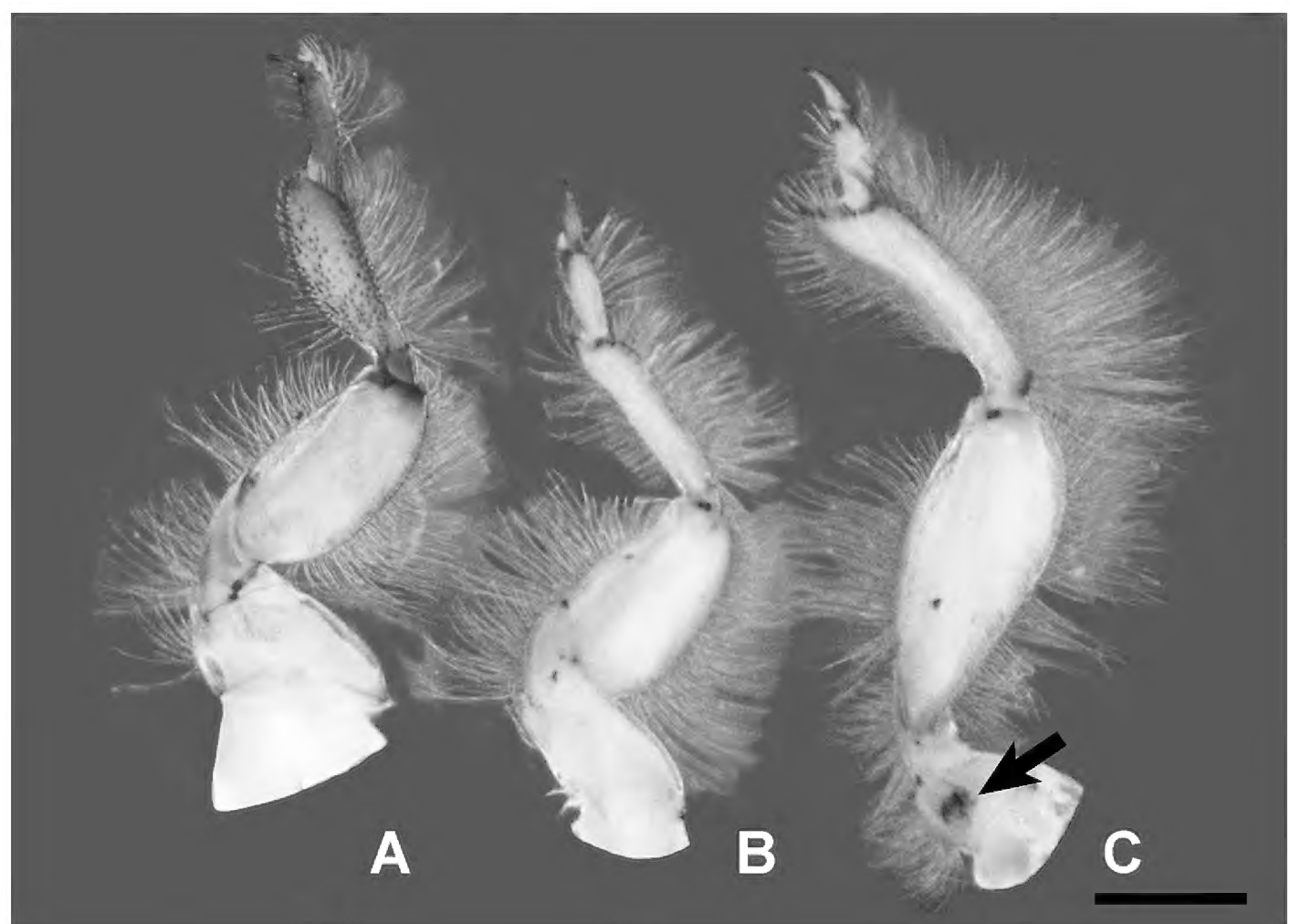


Figure 1. *Ephemera (Ephemera) spilosa* Navás, 1936. **A.** Larval habitus, dorsal view. **B.** head with frontal process, dorsal view. **C.** abdominal terga, dorsal view. Scale bars = 0.5 mm.

Figure 2. *Ephemera (Ephemera) spilosa* Navás, 1936. **A.** Foreleg, ventral view. **B.** Middle leg, ventral view. **C.** Hind leg, ventral view (arrow indicated black spot). Scale bars = 1 mm.



098°30'43.6"E; 1670 m alt.; 18.III.2023; Sedtawut Kwanboon leg.; 12 larvae in ethanol, ZMKU – CHIANG RAI • Doi Tung district, Ban Pang Nun Phatthana; 20°19'31.3"N, 099°44'15.2"E; 1000 m alt.; 28.XI.2023; Pattarawich Dawwrueng leg.; 3 larvae in ethanol, ZMKU.

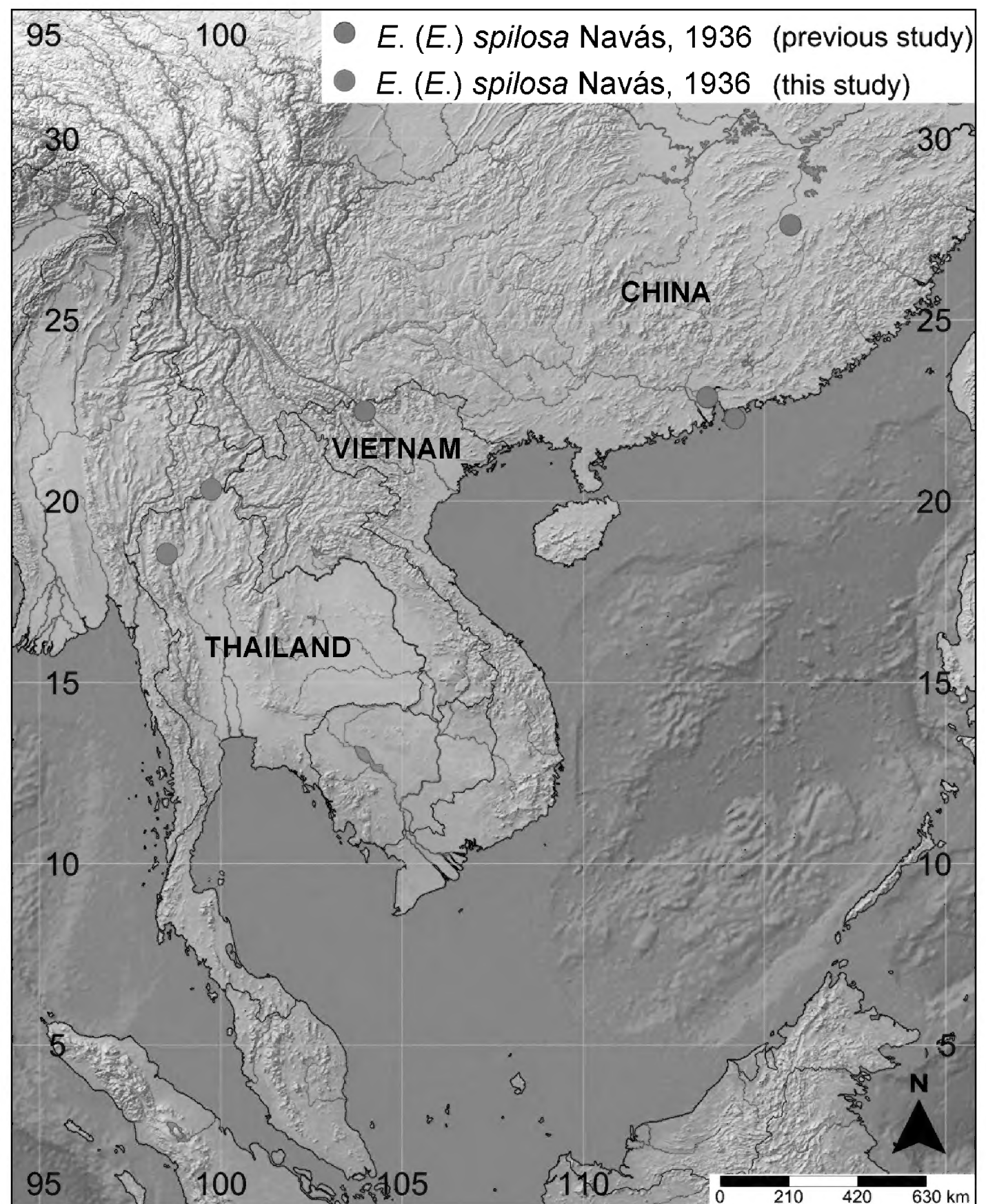


Figure 3. Distribution map of *Ephemera (Ephemera) spilosa* Navás, 1936.

Identification. The larvae of *E. spilosa* can be distinguished from other *Ephemera* species based on the following characters: i) one pair of stripes on abdominal terga III–IX (Figure 1C), and ii) a blackish spot present on the ventral view of the hind coxae (Figure 2C). The male imago of *E. spilosa* can be differentiated from other *Ephemera* species based on the following characters: i) hind coxae with a blackish spot, ii) hind wings lack dark brown markings, iii) abdominal terga III–IX with one pair of stripes, and iv) slender and long forceps; penes are blunt apically (Hwang and Bae 2008).

DISCUSSION

The discovery of an additional *Ephemera* species in Thailand underscores the considerable diversity of ephemerid mayflies in this country. The confirmation of *E. spilosa* based on nymphal morphological evidence agrees with the descriptions of Hwang and Bae (2008). *Ephemera spilosa* shares a closely related morphology with *E. serica*, which is characterised by one pair of stripes on the abdominal terga. However, these two species are differentiated by the number of spots on the coxae: *E. spilosa* exhibits a spot only the hind coxa, whereas *E. serica* has a spot on all coxae. The first report of *E. spilosa* was of the imaginal stage from the Hong Kong and Guangdong areas of southern China (Navás 1936; Hsu 1937). In addition, larvae of *E. spilosa* were collected from a mountain stream in the Sa Pa highland in Lao Cai province, northern Vietnam (Hwang and Bae 2008). In the present study, we collected *E. spilosa* from Siribhum Waterfall in Chiang Mai province, northern Thailand. This is the first record of this species in Thailand and confirms this species' geographic distribution beyond China and Vietnam (Figure 3). We propose that Thailand likely harbours numerous undiscovered ephemerid mayfly species yet to be documented.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

This research was approved by the Institutional Animal Care and Use Committee, Faculty of Science, Kasetsart University, Thailand under Project number ACKU61-SCI-028.

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Author contributions

Conceptualization: BB, SK. Data curation: SK. Formal analysis: SK, BB. Funding acquisition: BB. Investigation: SK, BB. Methodology: SK, BB. Resources: BB, SK. Supervision: BB. Visualization: SK. Project administration: BB. Software: SK, BB. Validation: BB. Writing – original draft: SK. Writing – review and editing: BB, SK.

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Data availability

All data that support the findings of this study are available in the main text.

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